Ovarian superovulation in South American camelids

Trasorras VL, Chaves MG, Carretero MI, Miragaya MH

Cátedra de Teriogenología, Instituto de Investigación y Tecnología en Reproducción Animal, Facultad de Ciencias Veterinarias, Universidad de Buenos Aires, Argentina

An increasing interest in the production of South American camelids has developed over the last few years. Camelids possess unique reproductive characteristics that constitute a challenge for the development of assisted reproductive techniques. Gestation length in these species varies between 335 and 360 days and only one offspring is born per year. Therefore, the average number of progeny any female can produce throughout her reproductive life is limited, making it hard to effectively spread a desired genome. Applying reproductive biotechnologies offers the possibility of increasing genetic progress and reproductive efficiency with the aim of optimizing reproductive management of genetically superior females.

Control of ovarian follicular growth: follicle wave inhibition

The need to produce multiple dominant follicles from one follicular wave requires the use of superovulatory treatments. According to Bourke et al. (1995a), when implementing ovarian superstimulation it is necessary to start hormone treatment in the absence of dominant follicles. Moreover, Miragaya et al. (2006) observed that when starting the treatment in the presence of a follicle larger than 5 mm, growth of only that follicle is induced. Due to these findings, superstimulatory treatments are applied to donor females in the absence of follicles greater than 5 mm (controlled by ultrasound).

Treatments applied

To achieve absence of dominant follicles prior to applying a superstimulatory treatment, some researchers have carried out the manual rupture of follicles greater than 5 mm by transrectal manipulation (Sansinena et al., 2007) or ablation of the follicle using transvaginal ultrasound-guided follicular aspiration (Ratto et al., 2003; 2005). Others have applied a superstimulatory treatment when the absence of follicles greater than 5 mm was confirmed by ultrasonography (alpacas: Ratto et al., 2007; llamas: Bravo et al., 1995; Berland et al., 2011; vicunas: Chaves et al., 2004). In addition, various protocols have been developed.
to inhibit ovarian dynamics based on the negative effect progesterone has on follicle activity in the presence of a corpus luteum (Aba et al., 1995). In this respect, a natural luteal phase, produced by inducing ovulation of the dominant follicle (Bourke et al., 1992, 1995b) or an artificial phase, by applying progesterone or exogenous progestogens, can be used. The latter can be found as injections (short or long-acting progestogens) or as releasing devices: subcutaneous implants with progesterone (Norgestomet®, 3 mg; Bourke et al., 1992, 1995b), intravaginal devices (CIDR®, 0.33 g; alpacas: Velásquez and Novoa, 1999; llamas: Bourke et al., 1992; Chaves et al., 1998, 2002; Cue-mate®, 0.78 g, Cavilla et al., 2006) or intravaginal sponges with medroxiprogesterone (MAP) (alpacas: Gamarra et al., 2006; llamas: Huanca et al., 2009). Progestogens can also be combined with injectable estrogens (17β estradiol, estradiol benzoate, estradiol valerate). Alberio and Aller (1996) used 50 mg of injectable progesterone over a period of 12 days, obtaining on Day 7 the inhibition of follicle diameter below 5 mm. Carretero et al. (2010) evaluated the efficacy of administering 100 and 150 mg of progesterone daily for 5 days, and observed that follicles decreased their size to 5 mm as early as day 3. This protocol is highly effective, the disadvantage being that it is not practical for use in the field (daily injections are needed) and it produces pain at the site of injection. For these reasons it would be useful to evaluate the effect of long-acting progesterone (requiring only one injection; BioRelease™ LA 300, BETPharm) on ovarian dynamics in the llama. Its formulation has been prepared to release progesterone for approximately 10 to 12 days after its i.m. administration. In horses it has been proven that 1500 mg of this compound maintains high progesterone levels (> 4 ng/ml) for 10 days (Burns et al., 2008). Our group has started to evaluate its effect in llamas and our preliminary results show a decrease in the size of the dominant follicle in 75% of the females 6 days after a single dose of 300 mg of progesterone. Initial plasma progesterone levels measured by radioimmunoassay showed a pronounced increase followed by a gradual decrease in concentration. According to these results, progesterone levels declined to < 2 nmol/l seven days after injection of progesterone BioRelease™ LA 300, therefore day 7 post-injection would be the best day to start ovarian superstimulation (Trasorras et al., unpublished data).

Ovarian superstimulation

The hormones most used to induce ovarian superstimulation in camelids are FSH and eCG, either individually or combined. However eCG is effective with a single administration, therefore with regard to reproductive management, it is more convenient to use than FSH,
which has a shorter half-life and therefore needs repeated doses over a period of time (Bravo et al., 1995; Agüero et al., 2001).

According to Bravo et al. (1995) administration of 500 or 1000 IU of eCG, in the absence of dominant follicles (controlled by ultrasound), are the optimal doses for superovulation in llamas and an increase in the incidence of cystic follicles was observed with higher doses (2000 IU). Trasorras et al. (2009) reported that 500 IU of eCG did not produce ovarian superstimulation after follicle inhibition with estradiol benzoate and CIDR®. In alpacas, administration of 1000 IU of eCG at the end of a CIDR® protocol produced a higher ovarian response (number of corpora lutea) than treatment during the follicular phase (no progesterone treatment); besides, females treated with eCG without pre-treatment with progesterone had a significantly higher incidence of follicular cysts (Velásquez and Novoa, 1999). According to our experience, treatments with 1000 or 1500 IU of eCG are effective for inducing multiple follicle growth in llamas, but administration of 1500 IU produces a higher number of follicles (Trasorras et al., 2009; Carretero et al., 2010). Administration of high doses of eCG can be beneficial for carrying out follicle aspiration to obtain oocytes for use in assisted reproductive techniques such as IVF and ICSI. On the other hand, when the objective is to obtain embryos through uterine flushing, its use could be detrimental due to the possible displacement of the ovarian bursa because of the large size of the superstimulated ovary. In vicuna, administration of a dose of 750 IU of eCG produced a potent stimulation of follicle growth, obtaining an average of 16.5 follicles per female (Aba et al., 2005). In these cases displacement of the ovarian bursa was observed and no embryos or oocytes were obtained from the uterine flushings, with the apparent loss of oocytes into the abdominal cavity (Agüero, personal communication).

In the near future, advances in technology will make new species specific recombinant hormones available for use in these species, thus opening new possibilities for obtaining better results with ovarian superstimulation.

References


